

FIG. 2

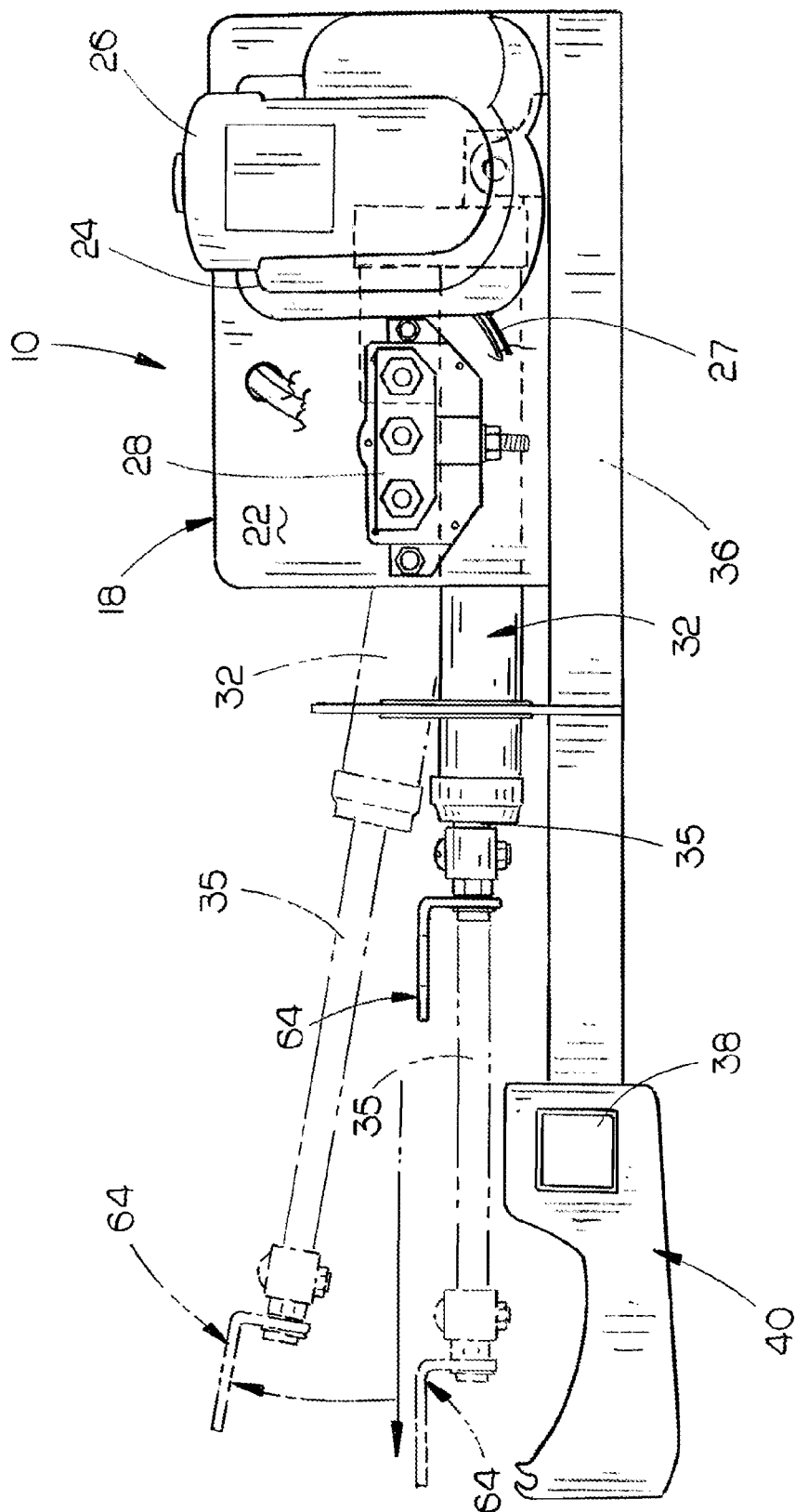


FIG. 3

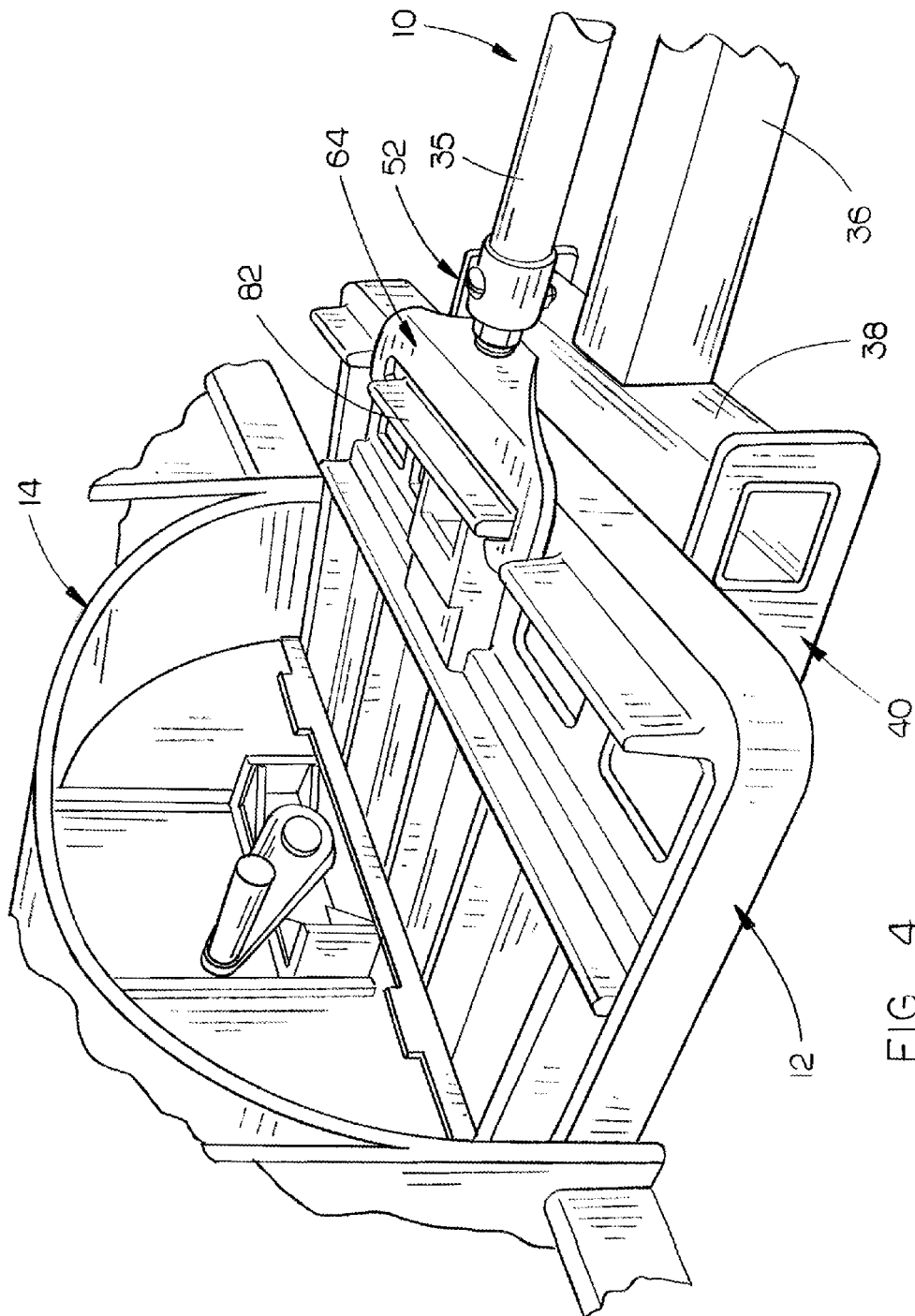


FIG. 4

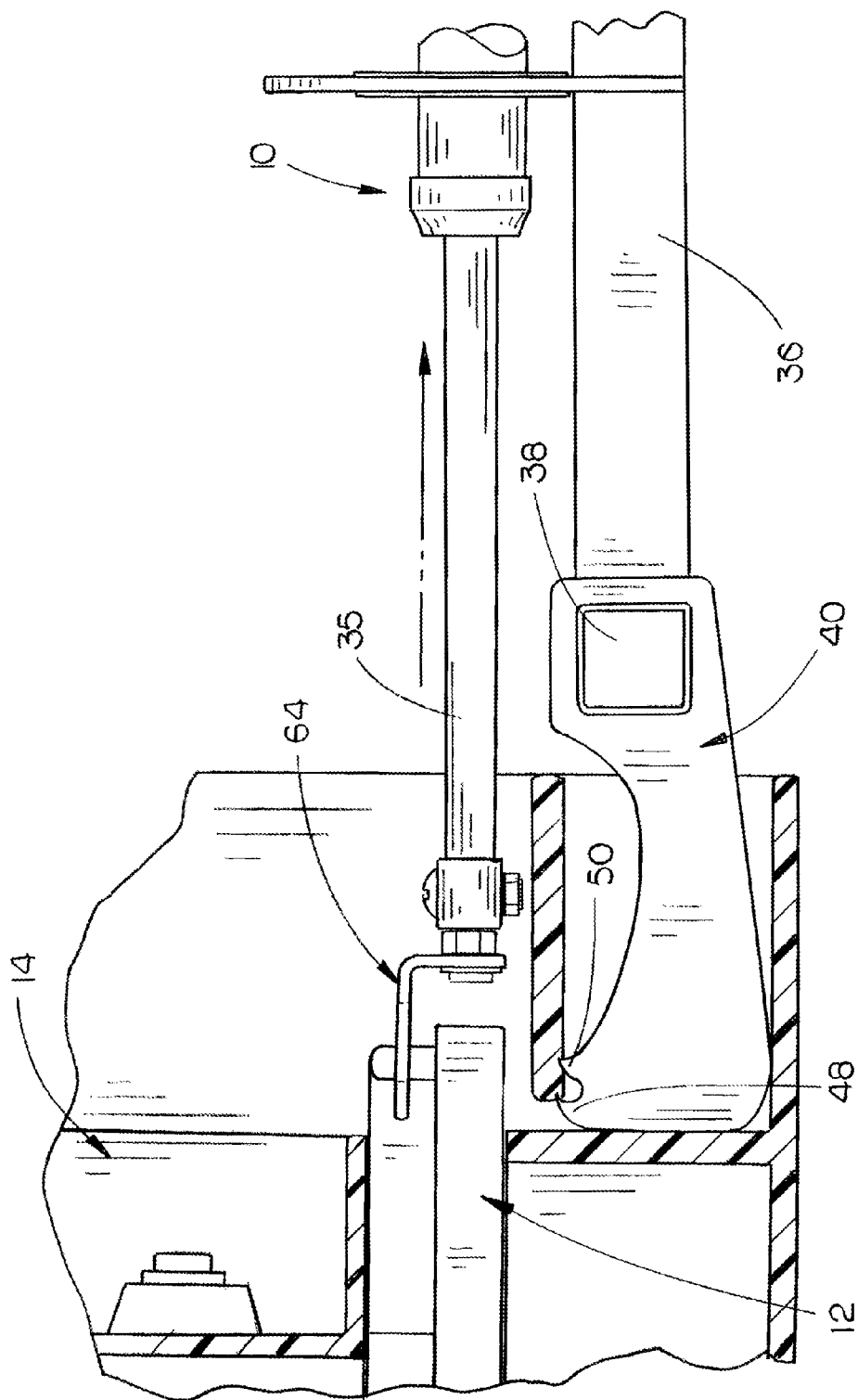


FIG. 5

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DEVICE FOR OPENING AND CLOSING THE DISCHARGE DOOR OF A BULK SEED BOX

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a device for opening and closing the discharge door of a bulk seed box and more particularly to a device which utilizes an electrically operated screw actuator or linear actuator to open and close the discharge door.

2. Description of the Related Art

Bulk seed systems have been in wide use for many years to eliminate the need for filling row planter boxes and grain drills with seed from individual bags. A popular type of bulk seed box is that which is manufactured by Buckhorn, Inc. of Milford, Ohio, who is the owner of U.S. Pat. Nos. 5,845,799 and 6,010,022 relating to bulk seed boxes. Pioneer Hi-Bred International, Inc. of Johnston, Iowa, markets agricultural seeds in large bulk seed boxes under the registered trademark PROBOX®. See also U.S. Pat. Nos. 5,094,356 and 7,086,342 which disclose bulk seed boxes having discharge doors or slide gates.

The bulk seed boxes of Buckhorn, Inc. and Pioneer have a sliding discharge door at the lower ends thereof through which the seed in the bulk seed box is dumped into a seed system, wagon, truck, etc. When the large bulk seed boxes are delivered to a farmer or the like, the bulk seed box is normally elevated above the ground by means of a forklift or a front end loader so that the contents of the bulk seed box may be dumped into a seed system/wagon/truck so that the seed may be conveyed therefrom into the planting devices. The fact that the bulk seed boxes are elevated above the truck or the like requires that a person climb upwardly on the truck or a ladder to manually open the discharge door. Further, the weight of the seed in the box sometimes causes the bulk seed box to slightly deform which makes it extremely difficult to manually open or close the discharge door. Applicant's invention described and shown in U.S. Pat. No. 8,137,043 issued Mar. 20, 2012 represents a vast improvement in the art. The instant invention represents a further improvement in the art.

SUMMARY OF THE INVENTION

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key aspects or essential aspects of the claimed subject matter. Moreover, this Summary is not intended for use as an aid in determining the scope of the claimed subject matter.

A lightweight portable device for opening and closing the discharge door of a bulk seed box is disclosed which is removably secured to the lower end of the bulk seed box while the bulk seed box is on the ground or other suitable supporting surface. The inner end of the device of this invention is selectively removably inserted into openings in the lower end of the bulk seed box at opposite sides of the discharge door. The device includes an electrically operated screw actuator or linear actuator which has a generally C-shaped connector mounted on the outer end of the actuator rod thereof which is selectively removably connected to the discharge door and which will pull the discharge door from its closed position to its open position as the actuator rod of the screw actuator is retracted. The C-shaped connector may also be used to push upon the extension of the actuator rod of the screw actuator.

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The device may be remotely controlled which eliminates the need for a person to climb up on a truck or ladder to manually operate the discharge door.

It is therefore a principal object of the invention to provide a device for opening and closing the discharge door of a bulk seed box.

A further object of the invention is to provide a device of the type described which includes an electrically operated screw actuator for moving the discharge door of the bulk seed box between its closed and open positions and vice versa.

Still another object of the invention is to provide a device for opening and closing the discharge door of a bulk seed box which may be remotely operated.

Yet another object of the invention is to provide a device for opening and closing the discharge door of a bulk seed box which is portable and lightweight.

These and other objects will be obvious to those skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

Non-limiting and non-exhaustive embodiments of the present invention are described with reference to the following figures, wherein like reference numerals refer to like parts throughout the various views unless otherwise specified.

FIG. 1 is a perspective view of the device of this invention with the actuator rod of the screw actuator being in its retracted position;

FIG. 2 is another perspective view of the device of this invention with the actuator rod of the screw actuator being in its retracted position;

FIG. 3 is a side elevational view of the device of this invention with broken lines illustrating the screw actuator in its extended position and in its elevated position;

FIG. 4 is a partial perspective view illustrating the C-shaped connector of the device being connected to the discharge door of a bulk seed box; and

FIG. 5 is a partial sectional view illustrating the C-shaped connector of the device connected to the bulk seed box and the discharge door thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Embodiments are described more fully below with reference to the accompanying figures, which form a part hereof and show, by way of illustration, specific exemplary embodiments. These embodiments are disclosed in sufficient detail to enable those skilled in the art to practice the invention. However, embodiments may be implemented in many different forms and should not be construed as being limited to the embodiments set forth herein. The following detailed description is, therefore, not to be taken in a limiting sense in that the scope of the present invention is defined only by the appended claims.

The numeral 10 refers to the door opening and closing device of this invention which is designed to open and close the sliding discharge door 12 of a bulk seed box 14 such as disclosed in U.S. Pat. Nos. 6,010,022 and 5,845,799, the disclosures of which are incorporated by reference thereto. In the '022 patent, the sliding door is identified as a cutoff device 50 which selectively closes the outlet 60 in the bottom wall of the base. In the '799 patent, the sliding discharge door is referred to as a cutoff device or flow control valve 89.

Device 10 includes a frame or support 18 which is shown to be L-shaped with a bottom plate 20 and an upstanding side plate 22. It should be noted that the support 18 could have

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other shapes as well. A conventional battery receptacle **24** is mounted on the outer side of plate **22** and is adapted to selectively removably receive a rechargeable battery **26** which in this case of the particular device is an 18-volt rechargeable battery such as marketed by Black & Decker. When positioned in receptacle **24**, the battery **26** is electrically connected to the electrical circuitry of the receptacle **24** in conventional fashion. Electrical leads **27** extend from receptacle **24** which are connected to a terminal block **28** which may include a transformer if necessary.

Terminal block **28** is electrically connected to a controller **30**, by leads **31**, which includes an RF receiver. Terminal block **28** is electrically connected to an electrically driven screw actuator **32** or linear actuator, by leads **33**, the base of which is pivotally secured to bottom plate **20**, about a horizontal axis, at **34**. Screw actuator **32** includes an extendable and retractable actuator rod **35**.

An elongated support **36** has its rearward end secured to the underside of plate **20** and extends forwardly therefrom. Support **38** is secured to the forward end of support **36** so as to be transversely disposed with respect thereto.

The numeral **40** refers to a vertically disposed plate having a rearward end **42** and a forward end **44**. As seen, the upper end of plate **40** is curved at **46**. The upper forward end of plate **40** has a pair of hooks **48** and **50** provided thereon.

The numeral **52** refers to a vertically disposed plate having a rearward end **54** and a forward end **56**. As seen, the upper end of plate **52** is curved at **58**. The upper forward end of plate **52** has a pair of hooks **60** and **62** extending upwardly therefrom. As seen, plates **40** and **52** are welded to the ends of support **38**.

A horizontally disposed C-shaped connector **64** is secured to the outer end of rod **35** of screw actuator **32** and has hooks **68** and **70** at the opposite ends thereof. As seen, the body **71** of screw actuator **32** extends through a handle **72** which includes side portions **74** and **76** and an upper portion **78**. The handle **72** not only provides a handle but also serves as a limit to the upward pivotal movement of the screw actuator **32** with respect to the support **36**.

The device **10** is used as follows. When the filled bulk seed box **14** is on the ground or other suitable supporting surface, the plates **40** and **52** are extended inwardly through openings in the bulk seed box **14** at opposite sides of the discharge door **12**. The rearward end of the device **10** is then moved downwardly, which is enhanced by the weight of the device **10**, so that the hooks **48**, **50** and **60**, **62** on the upper forward ends of the plates **40** and **52** respectively move upwardly into engagement with the bulk seed box **14** to hold the device **10** in place. At this time, the screw actuator **32** will usually be in its retracted position. The forward end of actuator **32** will then be pivotally moved upwardly to the uppermost dotted line position of FIG. 3. The remote controller fob **80**, which is an RF transmitter, will then be actuated to extend the actuator rod **35** to the upper dashed line position of FIG. 3 to position the connector **64** over the central upstanding wall portion **82** of discharge door **12**. The connector **64** is then lowered to engage the wall portion **82**.

The bulk seed box **14** may then be raised upwardly by a front-end loader or the like. When the box **14** is properly positioned over a seed system wagon, truck, or the like, the fob **80** will be actuated to cause the actuator rod **35** of actuator **32** to be retracted which will cause the discharge door to be opened. When the seed has been discharged from the box **14**, the fob **80** may be again activated to cause the actuator rod **35** to be extended from actuator **32** which will cause the connector **64** to push the discharge door **12** to its closed position. The instant invention is lightweight, portable and easy to operate.

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Although the device **10** has been described as being used to open and close the discharge door **12** of a bulk seed box **14** which is to be elevated above a seed system wagon, truck or the like, the device **10** may also be used to open and close the discharge door **12** of a bulk seed box which is positioned on a seed tender such as shown in U.S. Pat. Nos. 6,971,324 and 6,994,039.

Thus it can be seen that the invention accomplishes at least all of its stated objectives.

Although the invention has been described in language that is specific to certain structures and methodological steps, it is to be understood that the invention defined in the appended claims is not necessarily limited to the specific structures and/or steps described. Rather, the specific aspects and steps are described as forms of implementing the claimed invention. Since many embodiments of the invention can be practiced without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.

I claim:

1. A portable hand-held device for opening and closing a discharge door, having an inner end, an outer end, and opposite sides, which is horizontally slidably mounted at the lower end of a bulk seed box having an opening formed therein at each of the opposite sides of the discharge door adjacent the outer end thereof, the discharge door being movable between closed and open positions, comprising:

a support frame having a forward end and a rearward end; a rechargeable DC battery mounted on said support frame; an RF receiver mounted on said support frame;

a controller mounted on said support frame which is electrically connected to said battery and which is connected to said RF receiver;

an electrically driven screw actuator having a body with a retractable and extendable actuator rod movably extending therefrom;

said actuator being electrically connected to said controller;

said body including a base which is pivotally secured about a horizontal axis to said support frame so that said screw actuator may be pivotally raised and lowered with respect to said support frame;

an elongated and horizontally disposed first support having rearward and forward ends;

said rearward end of said first support being secured to said support frame and extending forwardly therefrom;

an elongated and horizontally disposed second support having first and second ends;

said second support being secured to said forward end of said first support so as to be transversely disposed with respect to said first support;

a vertically disposed first plate having a forward end, a rearward end, an upper end and a lower end;

said rearward end of said first plate being secured to said first end of said second support and extending forwardly therefrom;

a vertically disposed second plate having a forward end, a rearward end, an upper end, and a lower end;

said rearward end of said second plate being secured to said second end of said second support and extending forwardly therefrom;

said first and second plates being configured to be inserted into the openings on the seed box at the sides of the sliding discharge door;

said first and second plates being configured to engage the seed box to hold the device in place;

a generally C-shaped door engaging member secured to the outer end of said actuator rod;

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said C-shaped door engaging member being configured to engage the discharge door whereby the retraction of said actuator rod will cause the discharge door to be slidably moved to its open position and so that extension of said actuator rod will cause the discharge door to be moved to its closed position; and

an RF transmitter located remotely of the device for transmitting signals to said RF receiver whereby the discharge door may be opened and closed from a position remote from the device.

2. The device of claim 1 wherein each of said first and second plates has an arcuate recessed portion formed in said upper end thereof at said forward end thereof for engagement with the seed box to hold the device in place.

3. The device of claim 1 wherein said forward end of said first plate has at least one hook extending upwardly from its said forward end and wherein said forward end of said second plate has at least one hook extending upwardly from its said forward end with said hooks configured to engage the seed box to hold the device in place.

4. The device of claim 3 wherein said hooks also extend rearwardly from said forward ends of said first and second plates.

5. A portable hand-held device for opening and closing a discharge door, having an inner end, an outer end, and opposite sides, which is horizontally slidably mounted at the lower end of a bulk seed box having an opening formed therein at each of the opposite sides of the discharge door adjacent the outer end thereof, the discharge door being movable between closed and open positions, comprising:

a support frame having a forward end and a rearward end;
a rechargeable DC battery mounted on said support frame;
an RF receiver mounted on said support frame;
a controller mounted on said support frame which is electrically connected to said battery and which is connected to said RF receiver;

an electrically driven linear actuator having a body with a retractable and extendable actuator rod movably extending therefrom;

said body including a base which is pivotally secured about a horizontal axis to said support frame so that said linear actuator may be pivotally raised and lowered with respect to said support frame;

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an elongated and horizontally disposed first support having rearward and forward ends;

said rearward end of said first support being secured to said support frame and extending forwardly therefrom;

a vertically disposed first plate having a forward end, a rearward end, an upper end and a lower end;

said rearward end of said first plate being operatively secured to the forward end of said first support;

a vertically disposed second plate having a forward end, a rearward end, an upper end and a lower end;

said rearward end of said second plate being operatively secured to the forward end of said first support and being horizontally spaced from said first plate;

said first and second plates being configured to be inserted into the openings on the seed box at the sides of the sliding discharge door;

said first and second plates being configured to engage the seed box to hold the device in place;

a generally C-shaped door engaging member secured to the outer end of said actuator rod;

said C-shaped door engaging member being configured to engage the discharge door whereby the retraction of said actuator rod will cause the discharge door to be slidably moved to its open position and so that extension of said actuator rod will cause the discharge door to be moved to its closed position; and

an RF transmitter located remote of the device for transmitting signals to said RF receiver whereby the discharge door may be opened and closed from a position remote from the device.

6. The device of claim 5 wherein each of said first and second plates has an arcuate recessed portion formed in said upper end thereof at said forward end thereof for engagement with the seed box to hold the device in place.

7. The device of claim 5 wherein said forward end of said first plate has at least one hook extending upwardly from its said forward end and wherein said forward end of said second plate has at least one hook extending upwardly from its said forward end with said hooks configured to engage the seed box to hold the device in place.

8. The device of claim 7 wherein said hooks also extend rearwardly from said forward ends of said first and second plates.

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